

Claims

1. A hollow core multi-mode interference (MMI) device comprising a multi-mode waveguide optically coupled to at least two fundamental mode waveguides, characterised in that the device comprises a means for varying the internal cross-sectional dimensions of a portion of one or more of said at least two fundamental mode waveguides.
2. A device according to claim 1 wherein at least one of the fundamental mode waveguides has a substantially square cross-section.
3. A device according to any one of the preceding claims wherein the internal surfaces of the hollow core waveguides are coated with at least one layer of reflective material.
4. A device according to any one of the preceding claims wherein the device is formed in a semiconductor material.
5. A device according to claim 4 wherein the device is formed in silicon.
6. A device according to any one of the preceding claims wherein the means for varying the cross-sectional dimensions of a portion of said fundamental mode waveguide comprises micro-electro-mechanical (MEMS) actuation means.
7. A device for routing radiation comprising at least one device according to any one of the preceding claims.
8. A device according to any one of claims 1 to 5 wherein the means for varying the internal cross-sectional dimensions of a portion of said fundamental mode waveguide are arranged such that the fundamental mode waveguide dimensions can be varied by application of an external force.

9. An optical router comprising;

at least one fundamental mode input waveguide optically coupled to an MMI beam splitter, the MMI beam splitter also being optically coupled, via two or more relay waveguides, to an MMI beam recombiner having two or more fundamental mode output waveguides,

wherein the relay waveguides comprise a means for altering the relative phases between the two or more beams propagating through the relay waveguides such that radiation received from the fundamental mode input waveguide may be selectably routed to any one of the two or more fundamental mode output waveguides,

characterised in that the means for altering the relative phases between the two or more beams comprises a means for varying the cross-sectional dimensions of a portion of one or more of the relay waveguides.

10. An optical router comprising

a multi-mode waveguide region optically coupled to a plurality of input/output fundamental mode waveguides and a plurality of relay waveguides,

the router being configured to receive a beam of radiation via one of the plurality of input/output fundamental mode waveguides and, via modal dispersion in the multi-mode waveguide region, to divide the received beam into a plurality of beams that are coupled in to the relay waveguides,

wherein the relay waveguides comprise a means for altering the relative phases between the plurality of beams and each relay waveguide is terminated with a reflective means such that radiation is returned to the multimode waveguide region and, dependent on the relative phases of the returned beams, routed to any one of the input/output fundamental mode waveguides,

characterised in that the means for altering the relative phases between the plurality of beams comprises a means for varying the cross-sectional dimensions of a portion of one or more of the relay waveguides.

11. An optical phase shifter comprising a hollow core optical waveguide, characterised in that the phase shifter comprises means for varying the internal cross-sectional dimensions of a portion of said hollow core optical waveguide.